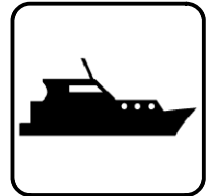


# Operation

## Marine Generator Sets



Models:

**5ECD/4EFCD-Low CO**  
**7.3ECD/6EFCD-Low CO**

**KOHLER®**

POWER SYSTEMS

**9001**  
**KOHLER**  
POWER SYSTEMS  
NATIONALLY REGISTERED

TP-6390 1/06a

## WARNING

## Product Identification Information

[illegible]

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# Safety Precautions and Instructions

**IMPORTANT SAFETY INSTRUCTIONS.** Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. **SAVE THESE INSTRUCTIONS.**

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

## DANGER

Danger indicates the presence of a hazard that **will cause severe personal injury, death, or substantial property damage.**

## WARNING

Warning indicates the presence of a hazard that **can cause severe personal injury, death, or substantial property damage.**

## CAUTION

Caution indicates the presence of a hazard that **will or can cause minor personal injury or property damage.**

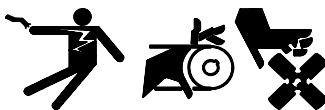
## NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

## Accidental Starting

### WARNING



**Accidental starting.  
Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

## Battery

### WARNING



**Sulfuric acid in batteries.  
Can cause severe injury or death.**

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.


**Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death.** Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

**Battery acid cleanup. Battery acid can cause severe injury or death.** Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

**Battery gases. Explosion can cause severe injury or death.** Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

**Battery short circuits. Explosion can cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

## Engine Backfire/Flash Fire

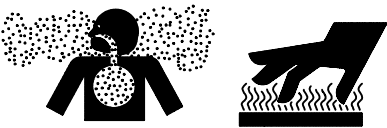
<b>⚠ WARNING</b>

<b>Fire.</b> <b>Can cause severe injury or death.</b>  Do not smoke or permit flames or sparks near fuels or the fuel system.


**Servicing the backfire flame arrester. A sudden backfire can cause severe injury or death.** Do not operate the generator set with the backfire flame arrester removed.

**Combustible materials. A sudden flash fire can cause severe injury or death.** Do not smoke or permit flames or sparks near the generator set. Keep the compartment and the generator set clean and free of debris to minimize the risk of fire. Catch fuels in an approved container. Wipe up spilled fuels and engine oil.

**Combustible materials. A fire can cause severe injury or death.** Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

## Engine Fluids and Chemical Products

<b>⚠ WARNING</b>

<b>Handling caustic engine fluids and chemical products.</b> <b>Can cause severe chemical burns, nausea, fainting, or death.</b>  Most chemicals such as used engine oil, antifreeze/coolant, rustproofing agent, inhibiting oil, degreasing agent, spray paint, and adhesives are hazardous to health. Read and follow the user information found on the packaging. Avoid inhalation and skin contact. Use only in well-ventilated areas and use a protective mask when spraying. Store engine fluids and chemical products in a locked cabinet. Contact your local recycling center for disposal information and locations.

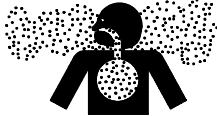
<b>⚠ WARNING</b>

<b>Flammable engine solvents and cleaners.</b> <b>Can cause severe injury or death.</b>  Do not smoke or permit flames or sparks near flammable engine solvents and cleaners. Read and follow the user information found on the packaging. Use only in well-ventilated areas. Never use gasoline or low flash-point solvents as cleaning agents.

**Leaking or accumulated engine fluids. A fire can cause severe injury or death.** Clean up engine fluids including fuel, oil, grease, and coolant. Determine the source of engine leaks and correct before starting the generator set. Keep the generator set area clean and remove combustible materials.

**Used engine oil. Contact with used engine oil may cause severe skin irritation. Repeated and prolonged skin exposure may have other health risks.** Used engine oil is a suspected carcinogen. Avoid contact with skin. Thoroughly wash your hands and nails with soap and water shortly after handling used engine oil. Wash or dispose of clothing or rags containing used engine oil. Dispose of used engine oil in a responsible manner. Contact your local recycling center for disposal information and locations.

## Exhaust System

### WARNING



**Carbon monoxide.**  
**Can cause severe nausea, fainting, or death.**

The exhaust system must be leakproof and routinely inspected.

**Carbon monoxide symptoms.**  
**Carbon monoxide can cause severe nausea, fainting, or death.** Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

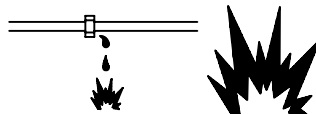
If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

**Inspecting the exhaust system.**  
**Carbon monoxide can cause severe nausea, fainting, or death.** For the safety of the craft's occupants, install a carbon monoxide detector. Consult the boat builder or dealer for approved detector location and installation. Inspect the detector before each generator set use. In addition to routine exhaust system inspection, test the carbon monoxide detector per the manufacturer's instructions and keep the detector operational at all times.

**Operating the generator set. Carbon monoxide can cause severe nausea, fainting, or death.** Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Use the following precautions when installing and operating the generator set. Do not install the exhaust outlet where exhaust can be drawn in through portholes, vents, or air conditioners. Avoid overloading the craft. If the generator set exhaust discharge outlet is near the waterline, water could enter the exhaust discharge outlet and close or restrict the flow of exhaust. Never operate the generator set without a functioning carbon monoxide detector. Be especially careful if operating the generator set when moored or anchored under calm conditions because gases may accumulate. If operating the generator set dockside, moor the craft so that the exhaust discharges on the lee side (the side sheltered from the wind). Always be aware of others, making sure your exhaust is directed away from other boats and buildings.

## Fuel System

### WARNING



**Explosive fuel vapors.**  
**Can cause severe injury or death.**

Use extreme care when handling, storing, and using fuels.

### WARNING



**Explosion.**  
**Gasoline vapors can cause explosion and severe injury or death.**

Before starting the generator set, operate the blower 4 minutes and check the engine compartment for gasoline vapors.

### WARNING



**Avoid high pressure fluids.**  
**Can cause severe injury or death.**

Do not work on high pressure fuel or hydraulic systems without protective equipment to protect hands, eyes, and body. Avoid the hazard by relieving pressure before disconnecting fuel injection pressure lines. Search for leaks using a piece of cardboard. Always protect hands, eyes, and body from high pressure fluids. If an accident occurs, seek medical attention immediately.

**The fuel system. Explosive fuel vapors can cause severe injury or death.** Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

**Explosive fuel vapors can cause severe injury or death.** Take additional precautions when using the following fuels:

**Gasoline**—Store gasoline only in approved red containers clearly marked GASOLINE.

**Draining the fuel system. Explosive fuel vapors can cause severe injury or death.** Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

**Pipe sealant. Explosive fuel vapors can cause severe injury or death.** Fuel leakage can cause an explosion. Use pipe sealant on all threaded fittings to prevent fuel leakage. Use pipe sealant that resists gasoline, grease, lubrication oil, common bilge solvents, salt deposits, and water.

**Ignition-protected equipment. Explosive fuel vapors can cause severe injury or death.** Gasoline vapors can cause an explosion. USCG Regulation 33CFR183 requires that all electrical devices (ship-to-shore transfer switch, remote start panel, etc.) must be ignition protected when used in a gasoline and gaseous-fueled environment. The electrical devices listed above are not ignition protected and are not certified to operate in a gasoline and gaseous-fueled environment such as an engine room or near fuel tanks. Acceptable locations are the wheelhouse and other living areas sheltered from rain and water splash.

## Hazardous Noise

### CAUTION






**Hazardous noise.**  
**Can cause hearing loss.**

Never operate the generator set without a muffler or with a faulty exhaust system.

**Engine noise. Hazardous noise can cause hearing loss.** Wear hearing protection when near an operating generator set. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss.

## Hazardous Voltage/ Electrical Shock

 <b>WARNING</b>	
	
<b>Hazardous voltage. Moving rotor. Can cause severe injury or death.</b>	
Operate the generator set only when all guards and electrical enclosures are in place.	

**Grounding electrical equipment. Hazardous voltage can cause severe injury or death.** Electrocutation is possible whenever electricity is present. Turn off the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.




**Disconnecting the electrical load. Hazardous voltage can cause severe injury or death.** Disconnect the generator set from the load by opening the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage. Do not use the safeguard circuit breaker in place of the line circuit breaker. The safeguard circuit breaker does not disconnect the generator set from the load.


**Short circuits. Hazardous voltage/current can cause severe injury or death.** Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.


**Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death.** Connect the generator set to the building/marina electrical system only through an approved device and after the building/marina main switch is opened. Backfeed connections can cause severe injury or death to utility personnel working on power lines and/or personnel near the work area. Some states and localities prohibit unauthorized connection to the utility electrical system. Install a ship-to-shore transfer switch to prevent interconnection of the generator set power and shore power.

**Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death.** Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. (600 volts and under)

## Hot Parts

<b>⚠ WARNING</b>

<b>Hot coolant and steam. Can cause severe injury or death.</b>
Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.



<b>⚠ WARNING</b>

<b>Hot engine and exhaust system. Can cause severe injury or death.</b>
Do not work on the generator set until it cools.

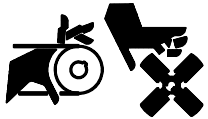
<b>⚠ WARNING</b>

<b>Hot engine oil. Can cause severe injury or death.</b>
Avoid skin contact with hot oil. Do not start or operate the generator set with the engine oil filler cap removed, as hot oil can spray out. Ensure that the lubrication system is not under pressure when servicing. Do not work on the generator set until it cools.

**Checking the coolant level. Hot coolant can cause severe injury or death.** Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

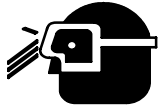
**Servicing the exhaust system. Hot parts can cause severe injury or death.** Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

## Moving Parts

<b>⚠ WARNING</b>	
	
<b>Hazardous voltage. Moving rotor. Can cause severe injury or death.</b>	
Operate the generator set only when all guards and electrical enclosures are in place.	

<p><b>⚠ WARNING</b></p>

<p><b>Rotating parts.</b> <b>Can cause severe injury or death.</b></p> <p>Operate the generator set only when all guards, screens, and covers are in place.</p>

---

<p><b>⚠ WARNING</b></p>

<p><b>Airborne particles.</b> <b>Can cause severe injury or blindness.</b></p> <p>Wear protective goggles and clothing when using power tools, hand tools, or compressed air.</p>

---

**Tightening the hardware. Flying projectiles can cause severe injury or death.** Loose hardware can cause the hardware or pulley to release from the generator set engine and can cause personal injury. Retorque all crankshaft and rotor hardware after servicing. Do not loosen the crankshaft hardware or rotor throbolt when making adjustments or servicing the generator set. Rotate the crankshaft manually in a clockwise direction only. Turning the crankshaft bolt or rotor throbolt counterclockwise can loosen the hardware.

**Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

**Sound shield removal. Exposed moving parts can cause severe injury or death.** The generator set must be operating in order to perform some scheduled maintenance procedures. Be especially careful if the sound shield has been removed, leaving the belts and pulleys exposed. *(Sound-shield-equipped models only)*

## Notice

### NOTICE

**Hardware damage.** The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

### NOTICE

**When replacing hardware, do not substitute with inferior grade hardware.** Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings, and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

### NOTICE

**Electrostatic discharge damage.** Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

### NOTICE

**Fuse replacement.** Replace fuses with fuses of the same ampere rating and type (for example: 3AB or 314, ceramic). Do not substitute clear glass-type fuses for ceramic fuses. Refer to the wiring diagram when the ampere rating is unknown or questionable.

### NOTICE

**Saltwater damage.** Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

This manual provides operation instructions for 5/7.3ECD and 4/6EFCD model generator sets.

Refer to the engine operation manual for generator set engine scheduled maintenance information.

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

Read this manual and carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions and Instructions section at the

beginning of this manual. Keep this manual with the equipment for future reference.

The equipment service requirements are very important to safe and efficient operation. Inspect the parts often and perform required service at the prescribed intervals. Obtain service from an authorized service distributor/dealer to keep equipment in top condition.

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**Before installing a marine generator set, obtain the most current installation manual from your local distributor/dealer. Only qualified persons should install the generator set.**

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## Service Assistance

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For professional advice on generator power requirements and conscientious service, please contact your nearest Kohler distributor or dealer.

- Consult the Yellow Pages under the heading Generators—Electric
- Visit the Kohler Power Systems website at [KohlerPowerSystems.com](http://KohlerPowerSystems.com)
- Look at the labels and stickers on your Kohler product or review the appropriate literature or documents included with the product
- Call toll free in the US and Canada 1-800-544-2444
- Outside the US and Canada, call the nearest regional office

### **Headquarters Europe, Middle East, Africa (EMEA)**

Kohler Power Systems  
ZI Senia 122  
12, rue des Hauts Flouviars  
94517 Thiais Cedex  
France  
Phone: (33) 1 41 735500  
Fax: (33) 1 41 735501

### **Asia Pacific**

Power Systems Asia Pacific Regional Office  
Singapore, Republic of Singapore  
Phone: (65) 6264-6422  
Fax: (65) 6264-6455

### **China**

North China Regional Office, Beijing  
Phone: (86) 10 6518 7950  
(86) 10 6518 7951  
(86) 10 6518 7952  
Fax: (86) 10 6518 7955

East China Regional Office, Shanghai  
Phone: (86) 21 6288 0500  
Fax: (86) 21 6288 0550

### **India, Bangladesh, Sri Lanka**

India Regional Office  
Bangalore, India  
Phone: (91) 80 3366208  
(91) 80 3366231  
Fax: (91) 80 3315972

### **Japan, Korea**

North Asia Regional Office  
Tokyo, Japan  
Phone: (813) 3440-4515  
Fax: (813) 3440-2727

### **Latin America**

Latin America Regional Office  
Lakeland, Florida, USA  
Phone: (863) 619-7568  
Fax: (863) 701-7131

# Maintenance and Service Parts/Related Literature

## Maintenance and Service Parts

Figure 1 identifies maintenance and service parts for your generator set. Obtain a complete list of maintenance and service parts from your authorized generator distributor/dealer.

Part Description	Part Number
Fuse, (F1) 10 amp, Auxiliary Winding	358337
Fuse, (F2) 10 amp, Controller	223316
Fuse, (F3) 10 amp, Customer Connection	223316
Fuse, (F4) 15 amp, Coils/Injectors	283645
Fuse, (F5) 15 amp, ECM, O <sub>2</sub> Sensor, and Fuel Pumps	283645
Fuse, (F6) 15 amp, Voltage Regulator and Battery Charging Alternator	283645
Fuse, (F7) 20 amp, Starter Motor and Crank Solenoid	GM39266
Oil Filter	359771
Seawater Pump Impeller Kit	359978
Spark Plug	GM46180
Spray Paint (White)	221335
Zinc Anode	260085

**Figure 1** Maintenance and Service Parts

xin:001:004

## List of Related Literature

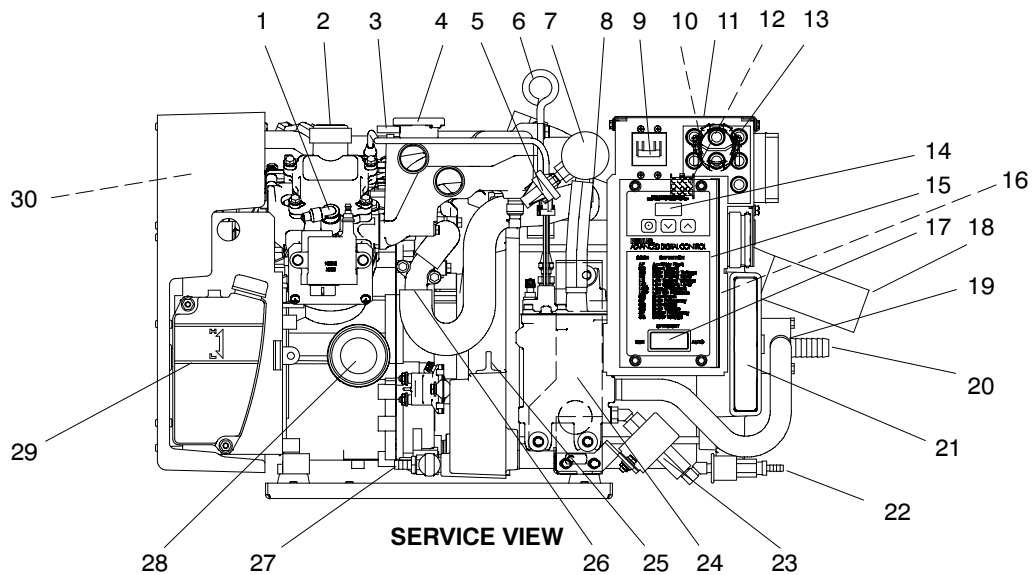
Figure 2 identifies related literature available for the generator sets covered in this manual. Only trained and qualified personnel should install or service the generator set.

Literature Type	Part Number
Installation Manual	TP-5982
Operation Manual (Generator)	TP-6390
Operation Manual (Engine)	TP-6001
Parts Catalog*	TP-5987
Service Manual (Generator)	TP-6391
Service Manual (Engine)	TP-6002
Service Manual Supplement (Engine)	TP-6008

\* One manual combines Generator and Engine information.

**Figure 2** Generator Set Literature

xin:001:005



ADV7025A-A

1. Spark plug (also one located on the nonservice side)
2. Oil fill
3. Overflow tube
4. Pressure cap (coolant fill location after draining coolant)
5. Seawater pressure switch (appears as auxiliary fault on ADC)
6. Lifting eye
7. Heat exchanger
8. Anticorrosion zinc anode
9. AC circuit breaker
10. AC load lead connector (nonservice side)
11. Nameplate (top)
12. Customer interface connection (nonservice side)
13. Fuses (F1, F2, F3, F4, F5, F6, and F7)  
(see Section 2.7.2)
14. Runtime hour display
15. Advanced Digital Control (ADC 2100)
16. CO sensor module
17. Generator set master switch

18. Catalyst assembly, water outlet/exhaust outlet (nonservice side)
19. Seawater drain (remove plate for service)
20. Seawater pump (water inlet)
21. Cooling air inlet
22. Fuel filter/fuel inlet
23. Fuel pump
24. Fuel pump/cooler
25. Oil check
26. Coolant drain (remove hose clamp to drain coolant)
27. Oil drain valve
28. Lube oil filter
29. Coolant overflow bottle (daily coolant check/fill location)
30. Air intake silencer/backfire flame arrestor

**Note:** Consult installation drawings in Spec Sheet or Installation Manual for fuel- and battery-connection points.

**Note:** Consult distributor/dealer or Service Manual for items not shown.

**Figure 1-1** Service Views

**Notes**

### 2.1 Prestart Checklist

To ensure continued satisfactory operation perform the following checks or inspections before or at each startup, as designated, and at the intervals specified in the service schedule. In addition, some checks require verification after the unit starts.

**Air Inlets.** Check for clean and unobstructed air inlets.

**Air Shrouding.** Check for securely installed and positioned air shrouding.

**Backfire Flame Arrester.** Check for a clean and installed backfire flame arrester to prevent unfiltered air from entering the engine.

**Battery.** Check for tight battery connections. Consult the battery manufacturer's instructions regarding battery care and maintenance.

**Coolant Level.** Check the coolant level according to the cooling system maintenance information.

**Exhaust System.** Check for exhaust leaks and blockages. Check the silencer and piping condition and check for tight exhaust system connections.

Inspect the exhaust system components (exhaust manifold, catalyst, exhaust hose, hose clamps, silencer, and outlet flapper) for cracks, leaks, and corrosion.

- Check the hoses for softness, cracks, leaks, or dents. Replace the hoses as needed.
- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps. Tighten or replace the hose clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Visually inspect for exhaust leaks (*blowby*). Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.
- Ensure that the carbon monoxide detector(s) is (1) in the craft, (2) functional, and (3) energized whenever the generator set operates.

**For your safety:** Never operate the generator set without a functioning carbon monoxide detector(s) for your safety and the safety of others on your vessel.

**Fuel Level.** Check the fuel level and keep the tank(s) full to ensure adequate fuel supply.

**Oil Level.** Maintain the oil level at or near, not over, the full mark on the dipstick.

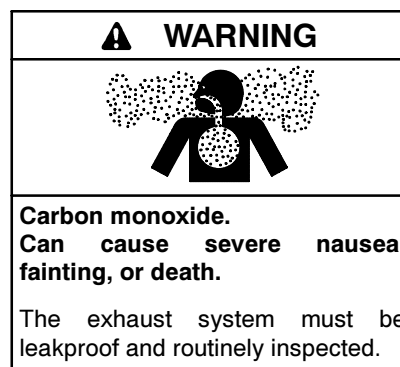
**Operating Area.** Check for obstructions that could block the flow of cooling air. Keep the air intake area clean. Do not leave rags, tools, or debris on or near the generator set.

**Seawater Pump Priming.** Prime the seawater pump before initial startup. To prime the pump: (1) close the seacock, (2) remove the hose from the water-filter outlet, (3) fill the hose and seawater pump with clean water, (4) reconnect the hose to the water filter outlet, and (5) open the seacock. Confirm seawater pump operation on startup as indicated by water discharge from the exhaust outlet.

### 2.2 Marine Inspection

Kohler Co. recommends that all boat owners have their vessels inspected at the start of each boating season by the US Coast Guard, the local Coast Guard Auxiliary, or local state agency.

Kohler Co. also recommends having the generator's exhaust system inspected at the start of each boating season by an authorized Kohler® distributor/dealer. Repair any problems identified before operating the generator set.



## 2.3 Angular Operation

See Figure 2-1 for angular operation limits for units covered in this manual.

Continuous	Intermittent— 3 minutes or less
25°	30°
Maximum value for all directions	

**Figure 2-1** Angular Operation

## 2.4 Operation in European Union Member Countries

This generator set is specifically intended and approved for operation below the deck in the engine compartment. Operation above the deck and/or outdoors would constitute a violation of European Union Directive 2000/14/EC noise emission standard.

## 2.5 Load Profile

Whenever operating the generator set, Kohler Co. recommends maintaining the minimum load profile indicated in Figure 2-2. Maintaining the load profile prevents corrosion formation on internal engine components when they're exposed to the breakdown of exhaust gases.

Minimum Load Requirement	Ideal Load Requirement
30% load	70% load or more

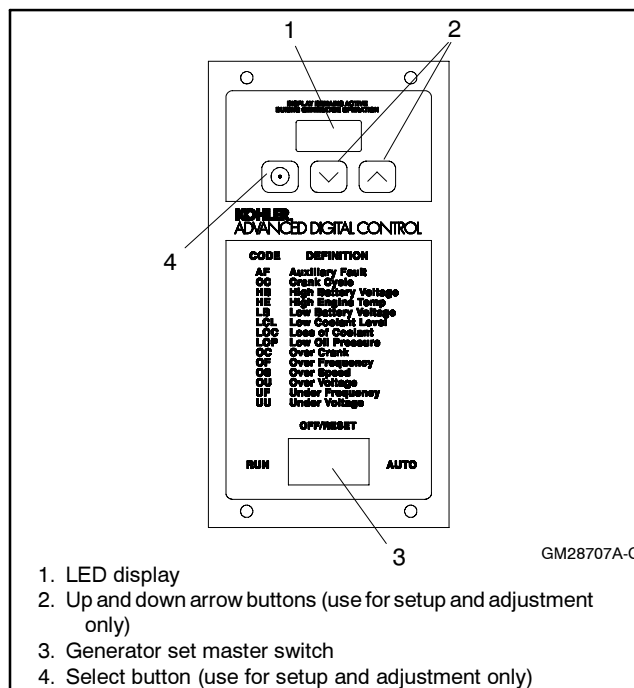
**Figure 2-2** Load Profile

The operator should perform all of the prestart checks. Start the generator set according to the starting procedure in the controller section of this manual. While the generator set is operating, listen for a smooth-running engine and visually inspect the generator set for fluid or exhaust leaks.

## 2.6 Advanced Digital Control Operation

Figure 2-3 illustrates the user interface on the Advanced Digital Control (ADC 2100).

**Note:** Have setup and adjustments of the ADC 2100 performed only by an authorized Kohler distributor/dealer. The setup and adjustments are password protected.



**Figure 2-3** ADC 2100 Control

### 2.6.1 Controls and Indicators

Figure 2-4 describes the controls and indicators located on the controller. The LED display indicates generator set status as shown in Figure 2-4. The display is active when the master switch is in the RUN or AUTO position and remains active until the generator set master switch is moved to the OFF/RESET position or the power to the controller is removed.

The buttons on the controller keypad are used only for system configuration and adjustment. The controller is factory-set and should not require configuration or adjustment under normal operating conditions. If the generator set is reconnected to a different voltage and/or frequency, refer to an authorized Kohler distributor/dealer for system configuration and adjustment instructions.




Control or Indicator	Item	Description
LED display	Runtime hours	Displays total generator set runtime hours.
	Crank indication	Displays CC_1, CC_2, or CC_3 to indicate the first, second or third attempt to start the engine. The last digit flashes during the crank cycle rest periods.
	Fault codes	Flashes a 2- or 3-letter fault code to indicate various fault conditions. See Section 2.6.4.
	Software version	See TP-5982, Generator Set Installation Manual.
Keypad	Select and arrow buttons	The keypad is used for controller setup and adjustment only. Have setup and adjustments performed only by an authorized distributor/dealer. The setup and adjustment functions are password-protected.
Generator set master switch	Three-position switch	Switch functions as the generator set operation and controller reset switch.

**Figure 2-4** ADC 2100 Controls and Indicators

## 2.6.2 Starting the Generator Set

The following procedures describe the actions required to start the generator set.

<b>⚠ WARNING</b>

<p><b>Explosion.</b> Gasoline vapors can cause explosion and severe injury or death.</p> <p>Before starting the generator set, operate the blower 4 minutes and check the engine compartment for gasoline vapors.</p>

Step	Action
1	<b>Operate the blower.</b> Operate the blower 4 minutes and check the engine compartment for gasoline vapors. <b>NOTE:</b> Many boat manufacturers recommend continuous blower operation while the generator set is operating. Read the vessel's owner's manual for further information.
2	<b>Open the fuel shut-off valve.</b> Open the manual fuel shut-off valve, if equipped.
3	<b>Start the generator set</b> Place the generator set master switch to the RUN position.

**Note: Opening seacock.** Before starting the generator set, open the seacock to allow cooling water passage. Failure to do so could damage the seawater pump impeller and cause serious engine overheating damage.

**Note: Transfer switch.** Check that the marine ship-to-shore transfer switch, if equipped, is in the ship position.

**Note: Close seacock if water enters the exhaust system.** If water enters the exhaust system, close the seacock and drain the water from the exhaust system at the silencer's drain plug before attempting to start the generator set. A water-filled exhaust hose and silencer may hinder generator starting and cause seawater entry into the engine cylinders through the exhaust valves. Water ingested into the engine may cause major engine damage that the Kohler Co. warranty does not cover. If excessive cranking is a chronic problem, have the unit, including the exhaust system, serviced by an authorized Kohler® distributor/dealer.

The controller attempts to start the generator set three times. If the generator set does not start in three attempts, the system shuts down on an overcrank fault.

### Local Starting.

Move the generator set master switch to the RUN position. The ADC 2100 attempts to start the generator set in three crank cycles (crank cycle time is pre-programmed).

### Auto (Automatic) Starting.

Move the generator set master switch to the AUTO position to allow startup by the remote start/stop switch or remote digital gauge. A remote start/stop switch or digital gauge can be connected to the customer interface connection (P21 connector, leads 3 and 4). See the wiring diagram in Section 5.

**Note:** The ADC 2100 allows three crank cycle attempts before the overcrank shutdown occurs.

### 2.6.3 Stopping the Generator Set

The following procedures describe the actions required to stop the generator set.

#### Local Stopping

1. Run the generator set at no load for at least 2 minutes to ensure adequate engine cooldown.
2. Move the generator set master switch to the OFF/RESET position. The engine stops.

#### Auto (Automatic) Stopping.

1. Run the generator set at no load for at least 2 minutes to ensure adequate engine cooldown.
2. With the generator set master switch in the AUTO position, the generator set stops when the remote start/stop switch contacts close momentarily.

**Note:** If the ADC 2100 is configured for a digital gauge, the controller will not power down (if the master switch is in the AUTO position). See Section 2.6.7.

**Note:** If the ADC 2100 is not configured for a digital gauge, the controller will power down after 48 hours (if the master switch is in the AUTO position). If the generator has been started, the controller will power down 48 hours after the generator stops.

### 2.6.4 Fault Shutdowns

The generator set shuts down automatically under the fault conditions listed in Figure 2-5 and the controller displays a fault code. The generator set cannot be restarted until the fault condition is corrected and the controller is reset. See Section 2.6.6 to reset the controller after a fault shutdown. The controller resets automatically after a battery voltage fault condition is corrected.

Shutdown switches on the generator set automatically reset when the problem is corrected. The high engine temperature switch automatically resets when the generator set cools. However, the fault does not clear until the controller is reset.

The controller displays a fault code but the generator set does not shut down under the conditions shown in Figure 2-6.

Code	Fault	Description	Check
AF	Auxiliary fault input shutdown	Input from a customer-supplied switch that closes when the fault is active. Shutdown occurs 0.3 seconds after the fault is detected. This protection becomes active 3-seconds after crank disconnect.	Check the cause of the auxiliary fault.
CO-1	Carbon monoxide shutdown	Sensor fault shutdown occurs because of the presence of CO.	<b>Immediate service required.</b> Contact an authorized distributor/dealer for service. Ensure windows are open for proper ventilation. Operate the blower to expel dangerous fumes. Move the vessel away from other vessels (as another vessel may be the source for the presence of the CO). Check the generator exhaust system (see Section 3.6).
CO-2	Carbon monoxide shutdown	Shutdown occurs because of the presence of CO or deteriorating emission-control components (such as the catalyst).	<b>Immediate service required.</b> Contact an authorized distributor/dealer for service. Ensure windows are open for proper ventilation. Operate the blower to expel dangerous fumes. Move the vessel away from other vessels (as another vessel may be the source for the presence of the CO). Check the generator exhaust system (see Section 3.6).
CO-3	Carbon monoxide sensor shutdown	Shutdown occurs if communication is lost between the CO sensor and the ADC.	Check the connections to the CO sensor. If connections are okay, replace the CO sensor. Contact an authorized distributor/dealer for service.
HE	High engine temperature shutdown	Shutdown occurs if the engine coolant temperature exceeds the maximum temperature for more than 5 seconds. This protection becomes active after the engine reaches the crank disconnect speed. <b>Note:</b> The high engine temperature shutdown functions only when the coolant level is in the operating range.	Check for a low engine coolant level.
LOC	Loss of coolant shutdown	Shutdown occurs 5 seconds after a loss of coolant condition is detected. This protection becomes active 10 seconds after the engine has reached its stated crank disconnect speed and remains active as long as the generator run command is active.	Check for a clogged seawater intake or sea strainer. Check for a damaged seawater pump impeller.
LOP	Low oil pressure shutdown	Shutdown occurs if a low oil pressure condition exists for more than 5 seconds. This protection becomes active 30 seconds after the engine has reached crank disconnect speed (30 second inhibit). <b>Note:</b> The low oil pressure shutdown does not protect against low oil level. Check the oil level at the engine.	Check for leaks in the lubrication system. Check the oil level and add oil if the level is low.
OC	Overcrank shutdown	Shutdown occurs after 3 unsuccessful starting attempts. The crank cycle is set for three starting attempts.	Check the fuel supply and battery. If there is no output voltage, check the line circuit breaker. Also check for loose connections. Contact an authorized distributor/dealer for service if problem continues.
OF	Overfrequency shutdown	Shutdown occurs when the governed frequency exceeds 110% of the system's frequency setpoint for more than 5 seconds. This protection becomes active 10 seconds after engine start (10 second inhibit).	Contact an authorized distributor/dealer for service if problem continues.
OS	Overspeed shutdown	Shutdown occurs if the engine speed exceeds 115% of the normal running speed for more than 0.3 seconds.	Contact an authorized distributor/dealer for service if problem continues.
OU	Overvoltage shutdown	Shutdown occurs if the voltage exceeds 120% of the voltage regulator setpoint for more than 2 seconds.	Contact an authorized distributor/dealer for service if problem continues.
UF	Underfrequency shutdown	Shutdown occurs when the governed frequency falls below 90% of the system's frequency setpoint for more than 5 seconds. This protection becomes active 10 seconds after engine start (10-second inhibit).	Reduce the load and restart the generator set. Contact an authorized distributor/dealer for service if problem continues.
UU	Undervoltage shutdown	Shutdown occurs if the voltage falls below 80% of the voltage regulator setpoint for more than 10 seconds.	Reduce the load and restart the generator set. Contact an authorized distributor/dealer for service if problem continues.
SCF0	Controller error	Indicates a software or communication problem within the ADC 2100.	Contact an authorized distributor/dealer for service if problem continues.

**Figure 2-5** ADC 2100 Fault Shutdown Codes

Code	Fault	Description	Check
CO-4	Carbon monoxide warning	Fault code is displayed if the presence of CO is detected because of the time-weighted average presence of CO. Activates the CO cabin alarms.	<p>Ensure windows are open for proper ventilation.</p> <p>Operate the blower to expel dangerous fumes.</p> <p>Move the vessel away from other vessels (as another vessel may be the source for the presence of the CO).</p> <p>Check the generator exhaust system (see Section 3.6).</p> <p>Contact an authorized distributor/dealer for service if problem continues.</p>
CO-5	Carbon monoxide warning	Fault code is displayed if the presence of CO is detected. Warning occurs if the sensor detects acceptable but increasing CO levels.	<p>Ensure windows are open for ventilation.</p> <p>Operate the blower to expel dangerous fumes.</p> <p>Move the vessel away from other vessels (as another vessel may be the source for the presence of the CO).</p> <p>Check the generator exhaust system (see Section 3.6).</p> <p>Generator service for emissions required.</p> <p>Contact an authorized distributor/dealer for service if problem continues.</p>
CO-6	Carbon monoxide sensor warning	Fault code is displayed if the CO sensor is inoperative.	<p>Replace the CO sensor.</p> <p>Contact an authorized distributor/dealer for service if problem continues.</p>
HB	High battery voltage warning	<p>Fault code is displayed if the engine starting battery voltage rises above 16 VDC for a 12 VDC system or above 30 VDC for a 24 VDC system for more than 2 seconds when the engine is not running. This fault condition does not inhibit engine starting.</p> <p>The fault condition clears when the battery voltage returns to a voltage within the limits for more than 2 seconds.</p>	Check the battery rating and condition.
LB	Low battery voltage warning	<p>Fault code is displayed if the engine starting battery voltage falls below 9.5 VDC for a 12 VDC system or below 16 VDC for a 24 VDC system for more than 2 seconds when the engine is not running. This fault condition does not inhibit engine starting.</p> <p>The fault condition clears when the battery voltage returns to a voltage within the limits for more than 2 seconds.</p>	<p>Check the battery rating and condition.</p> <p>Charge or replace the battery.</p>

**Figure 2-6** ADC 2100 Fault Warning Codes

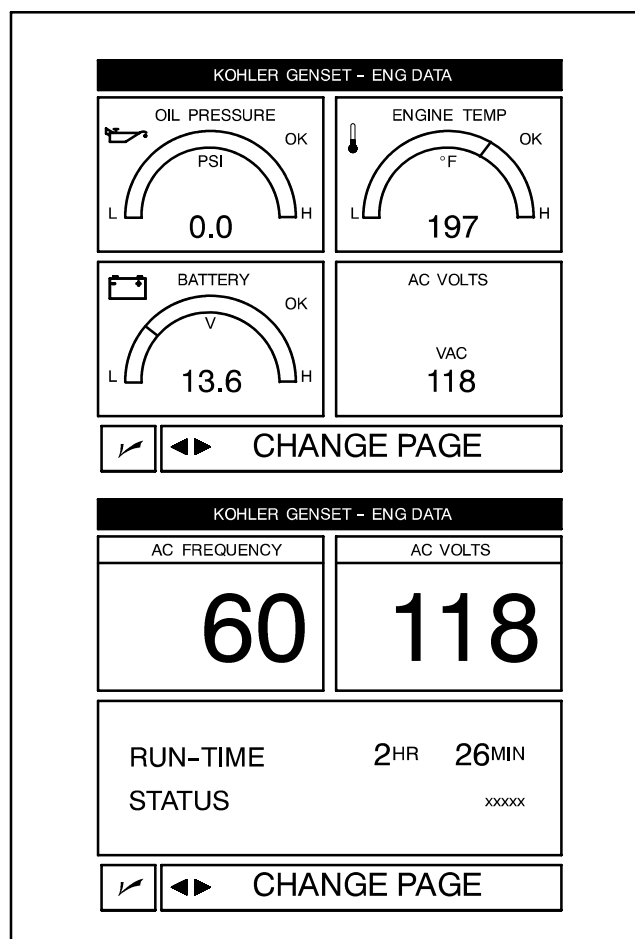
Fault Code Displayed	Description
	No Faults (Fault Code 0)
EC9	Throttle Position Sensor Input High
EC10	Throttle Position Sensor Range High
EC11	Throttle Position Sensor Range Low
EC12	Throttle Position Sensor Input Low
EC17	Speed Bias Pot Input High
EC18	Speed Bias Pot Input Low
EC39	Electronic Throttle Control Sticking
EC40	EST 1 Low
EC41	EST 1 High
EC42	EST 2 Low
EC43	EST 2 High
EC44	EST 3 Low
EC45	EST 3 High
EC46	Injector Fault
LOP	Low Oil Pressure
EC48	Electronic Throttle Control Spring Test Failed
EC49	Map Sensor Input High
EC50	Map Sensor Input Low
EC51	Electronic Throttle Control Driver Fault
HB	Battery Sensor Input High
LB	Battery Sensor Input Low
EC54	XDRP Sensor Input High
EC55	XDRP Sensor Input Low
EC56	Intake Air Temp. Input Sensor High
EC57	Intake Air Temp. Input Sensor Low
EC58	Coolant Sensor Input High
EC59	Coolant Sensor Input Low
EC60	Oxygen Sensor Input High
EC61	Oxygen Sensor Input Low
LOC	Seawater Pump Pressure
OS	Engine Overspeed Fault
HE	Coolant Sensor Range High
EC66	Trim Valve Output Fault
EC67	Trim Valve Lower DC Fault
EC68	Trim Valve Upper DC Fault
EC69	O <sup>2</sup> Switching Fault
EC70	Gaseous O <sup>2</sup> Adapt Limit Fault
EC72	CAN Receive Message Fault
EC73	Fuel Pump Fault
EC74	Starter Fault

**Figure 2-7** SECM Fault Codes (Appears on the ADC 2100 Display and Remote Digital Gauge)

## 2.6.5 SmartCraft™ System View (SC5000) Display, If Equipped

The 5/7.3ECD and 4/6EFCD model generator sets can connect to SmartCraft's SC5000 (if equipped) via the generator set's P19 connector. See the wiring diagrams in Section 5 for the P19 location. The SC5000 displays important generator set information as shown in Figure 2-8.

Consult the SmartCraft™ SC5000 literature provided with your vessel for display operation.



**Figure 2-8** 5/7.3ECD and 4/6EFCD Generator Display Screens on SC5000, Typical

SmartCraft™ is a trademark of Mercury Marine, a division of Brunswick Corporation.

### 2.6.6 Resetting the Controller after a Fault Shutdown

Always identify and correct the cause of a fault shutdown before resetting the controller. Use the following procedure to reset the generator set controller after a fault shutdown.

1. Move the generator set master switch to the OFF/RESET position.
2. Disconnect the generator set from the load using the line circuit breaker. See the safety precautions at the beginning of this manual before proceeding.
3. Identify and correct the cause of the fault shutdown. See the safety precautions at the beginning of this manual before proceeding. Refer to Section 4, Troubleshooting.
4. Start the generator set by moving the generator set master switch to RUN. Test operate the generator set to verify that the cause of the shutdown has been corrected.
5. Shut the generator off by moving the generator set master switch to the OFF/RESET position.
6. Reconnect the generator set to the load using the line circuit breaker.
7. Move the generator set master switch to the AUTO position for startup by remote transfer switch, remote start/stop switch, or remote digital gauge.

**Opening and closing the remote start/stop contact also resets the controller.**

### 2.6.7 Continuous Power Mode if Equipped with a Remote Gauge

The controller is powered by the generator set engine starting battery.

Remote communications require an active (powered-up) controller. Be advised that the ADC consumes 250 mA when the master switch is in the AUTO position. If you do not plan to use your generator set for a long period of time, Kohler recommends moving the master switch to the OFF/RESET position (complete power down—0 mA draw).

A remote start signal (from a transfer switch or a remote start/stop switch connected to P21 connector, leads 3 and 4) or moving the generator set master switch to the RUN position turns the controller back on.

## 2.7 Circuit Protection

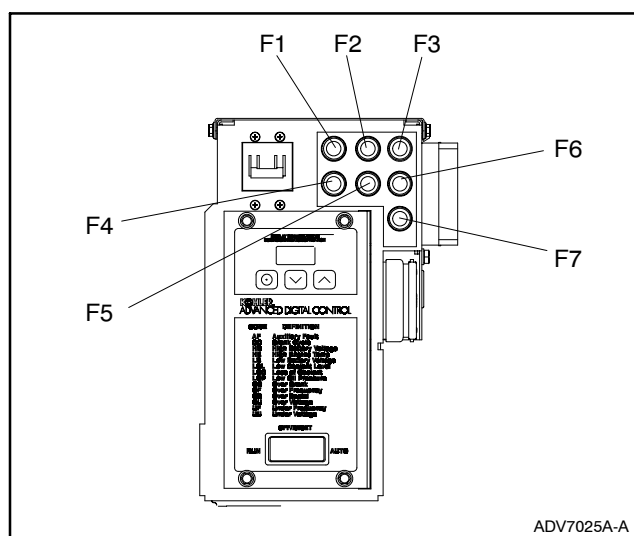
If the generator set circuit breaker trips or the fuses blow repeatedly, see Section 4 for possible causes.

### 2.7.1 Line Circuit Breaker

A line circuit breaker interrupts the generator output in the event of a fault in the wiring between the generator and the load. The line circuit breaker location is shown in Section 1. If the circuit breaker trips, reduce the load and switch the breaker back to the ON position.

### 2.7.2 Fuses

The junction box contains seven fuses. See Section 1 and Figure 2-9 for the fuse location. Always identify and correct the cause of a blown fuse before restarting the generator set. Refer to section 4 for conditions that may indicate a blown fuse. Obtain service from an authorized distributor/dealer.



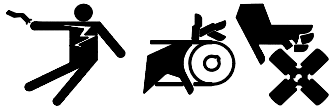
**Figure 2-9** Fuse Identification

Label	Fuse	Amps
F1	Auxiliary Winding	10
F2	Controller	10
F3	Customer Connection	10
F4	Coils/Injectors	15
F5	ECM, O <sub>2</sub> Sensor, and Fuel Pumps	15
F6	Voltage Regulator and Battery Charging Alternator	15
F7	Starter Motor and Crank Solenoid	20

**Figure 2-10** Fuses

### 3.1 General Maintenance

#### WARNING



**Accidental starting.**  
**Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

#### WARNING

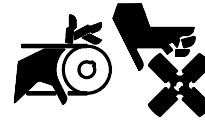


**Hot engine and exhaust system.**  
**Can cause severe injury or death.**

Do not work on the generator set until it cools.

**Servicing the exhaust system. Hot parts can cause severe injury or death.** Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

#### WARNING



**Rotating parts.**  
**Can cause severe injury or death.**

Operate the generator set only when all guards, screens, and covers are in place.

**Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death.** Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

**Sound shield removal. Exposed moving parts can cause severe injury or death.** The generator set must be operating in order to perform some scheduled maintenance procedures. Be especially careful if the sound shield has been removed, leaving the belts and pulleys exposed.  
(Sound-shield-equipped models only)

#### NOTICE

**Saltwater damage.** Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

#### NOTICE

**Hardware damage.** The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

**Annual Inspection.** Kohler Co. recommends that all boat owners have their vessels inspected at the start of each boating season by the US Coast Guard, the local Coast Guard Auxiliary, or local state agency.

Kohler Co. also recommends having the generator's exhaust system inspected at the start of each boating season by an authorized Kohler® distributor/dealer. Repair any problems identified before operating the generator set.

See the Safety Precautions and Instructions at the beginning of this manual before attempting to service, repair, or operate the generator set. Have an authorized distributor/dealer perform generator set service.

**Engine Service.** Perform generator set engine service at the intervals specified by the engine operation manual.

**Generator Set Service.** Perform generator set service at the intervals specified by the generator set operation manual.

If the generator set operates under dusty or dirty conditions, use *dry* compressed air to blow dust out of the alternator. With the generator set running, direct the stream of air in through the cooling slots at the alternator end.

**Routine Maintenance.** Refer to the following generator set service schedule, the engine service schedule, and the runtime hour display located on the generator set's

ADC to determine when to schedule routine maintenance. Service more frequently generator sets that are subject to extreme weather or dusty or dirty conditions.

**Service Log.** Use the Operating Hour Service Log located in the back of this manual to document performed services.

**Service Schedule.** Perform maintenance on each item in the service schedule at the designated intervals for the life of the generator set. For example, an item requiring service every 100 hours or 3 months also requires service after 200 hours or 6 months, 300 hours or 9 months, and so on.

x:sm:004:001

## 3.2 Service Schedule

Perform Service at Intervals Indicated (X)	Reference Section	Before Starting	After 50 Hrs or 1 Month	Every 100 Hrs or 3 Months	Every 300 Hrs or 6 Months	Every 500 Hrs or Yearly
<b>FUEL SYSTEM</b>						
Check the fuel level and fill as necessary	2.1	X				
Check fuel lines and replace as necessary *†					X	
Replace the fuel filter *†						X
<b>LUBRICATION SYSTEM</b>						
Check crankcase oil level and add as necessary	3.3.2	X				
Replace the oil in crankcase *	3.3.4		X (20 hrs break-in period)	X		
Replace the lube oil filter element *	3.3.5		X (20 hrs break-in period)	X (200 hrs)		
<b>COOLING SYSTEM</b>						
Check coolant level and fill as necessary *	3.7.1	X				
Check seawater outlet and clean as necessary †	3.7.6	X (during operation)				
Check function of siphon break, if equipped	3.7.4			X		
Replace seawater pump impeller *†	3.7.3				X (check)	X
Check heat exchanger anticorrosion zinc condition *	3.7.5			X		
Replace heat exchanger anticorrosion zinc *	3.7.5					X
Flush cooling system *†	3.7.1					X (400 hrs)
<b>IGNITION SYSTEM</b>						
Clean and regap spark plugs *	3.8			X		
Replace spark plugs *	3.8				X	

\* Requires removal of sound shield, if installed.

† Consult your local distributor/dealer for service.



## Service Schedule, continued

Perform Service at Intervals Indicated (X)	Reference Section	Before Starting	After 50 Hrs or 1 Month	Every 100 Hrs or 3 Months	Every 300 Hrs or 6 Months	Every 500 Hrs or Yearly
<b>INTAKE/EXHAUST SYSTEM</b>						
Inspect exhaust system components *†	3.6	X				
Check the exhaust gas condition	3.6	X (during operation)				
Service backfire flame arrestor *	3.5			X		
Check and/or replace the catalyst assembly *†	3.6					X
Replace the CO sensor module *†						X (Every 2 years)
Check the crankcase breather pipe for obstructions *†					X	
Inspect the complete exhaust system ***	3.6					X
<b>ELECTRICAL SYSTEM</b>						
Keep battery charged and in good condition ⊕	3.9	X				
Check and tighten electrical connections *			X			
Clean battery cables †				X (200 hrs)		
<b>ENGINE AND MOUNTING</b>						
Check for water, fuel, coolant, and oil leakage *†‡		X				
Retighten all nuts and bolts *		X				
Check tightness of mounting bolts/vibromounts *				X (200 hrs)		
Check and adjust valve clearance *†					X	
Clean combustion chamber *†					X	
<b>REMOTE CONTROL SYSTEM</b>						
Check remote control operation			X (break-in period)			X
<b>GENERATOR</b>						
Test run generator set			X (weekly)			
Blow dust out of generator *†	3.1					X
Clean slip rings and inspect brushes *†						X (1000 hrs.)

\* Requires removal of sound shield, if installed.

† Consult your local distributor/dealer for service.

‡ Read WARNING found at the beginning of manual regarding moving parts.

\*\*\* Should be performed by your local distributor/dealer.

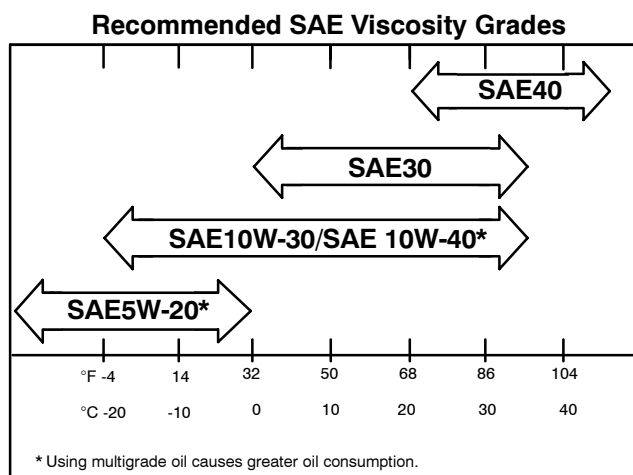
⊕ Consult battery manufacturer's instructions.

## 3.3 Lubrication System

### 3.3.1 Oil Specifications

Use oil that meets the American Petroleum Institute (API) classification of SC, SD, SE, SF, SG, or SH. Using unsuitable oil or neglecting an oil change may result in engine damage that is not covered by the engine warranty. Figure 3-1 shows the recommended Society of Automotive Engineers (SAE) viscosity designation for given operating temperature ranges.

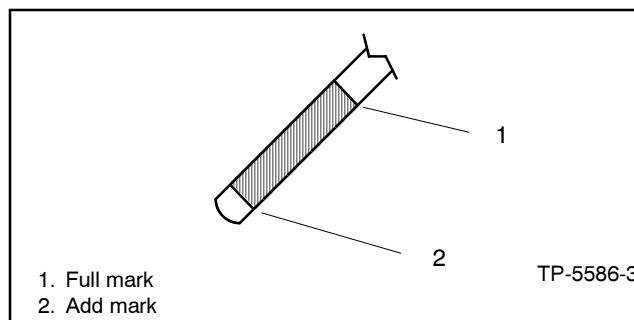
Do not mix different oil brands. Incompatibility could cause a breakdown of lubricating ingredients and reduce engine protection.



**Figure 3-1** Engine Oil Selection

### 3.3.2 Oil Check

Check the oil level in the crankcase daily or before each start-up to ensure that the level is in the safe range. Do not check the oil level while operating the unit. Stop the generator set and keep the generator set level to get an accurate reading. To check the oil level, remove the dipstick and wipe the end clean, reinsert and remove. Maintain the oil level between the Full and Add marks on the dipstick, as shown in Figure 3-2. See Section 1, Service Views for the dipstick location.



**Figure 3-2** Oil Level Check

**Note:** Do not operate the set if the oil level is below the Add mark on the dipstick or above the Full mark on the dipstick.

### 3.3.3 Oil Additions

Adding some oil between oil changes is normal. The amount varies with generator set usage. Open the oil fill cap and pour in a small amount of oil using a funnel or other suitable pouring device. See Section 1, Service Views for the oil check and oil fill locations.

### 3.3.4 Oil Change

Change the oil according to the service schedule or before generator set storage. Change the oil more frequently if the generator set operates under dirty, dusty conditions. Change the oil while the engine is still warm. See Figure 3-3 for oil capacity. See Section 1, Service Views for oil fill, oil check, and oil filter locations.

Model	L (Qts.)
All models	1.36 (1.44)

**Figure 3-3** Oil Capacity (with Filter)

## Oil Change Procedure

1. Stop the generator set.
2. To drain the oil, open the oil-drain valve. See Section 1 for the valve location.
3. Drain the oil into a suitable container.
4. Allow ample time for all oil to drain.
5. Close the oil-drain valve.
6. Remove the oil-fill cap.
7. Replace the engine oil filter according to the service schedule and the procedure in Section 3.3.5.
8. Fill crankcase with oil. Section 1 shows the oil fill location. See Figure 3-1 for oil selection and Figure 3-3 for oil capacity. Replace the oil-fill cap.
9. Start the generator set and check for oil leaks.
10. Stop the generator set. Check the oil level. Add oil, as necessary, to bring the level up to the Full mark.

**Note:** Too high an oil level causes high oil consumption and engine carbonizing. Too low a level damages the engine.

**Note:** Do not pollute the environment. Dispose of used engine oil and other contaminants in a safe, approved manner.

### 3.3.5 Oil Filter Change

Replace the oil filter at the interval specified in the service schedule. Change the oil filter more frequently if the generator set operates under dirty, dusty conditions. Refer to the following procedure. See Section 1 for oil filter location.

## Oil Filter Change Procedure

1. Loosen the oil filter by turning it counterclockwise. Remove the oil filter and use rags to clean up spilled oil. Dispose of the oil filter in an approved manner.
2. Clean the contact surface of the oil filter adapter.
3. Lightly lubricate the gasket surface of the new filter with fresh engine oil. Thread the filter on the adapter until the gasket makes contact and hand-tighten the filter an additional one-half turn. Wash hands after any contact with engine oil.

**Note:** If also performing an oil change, skip steps 4 and 5 and go back to oil change procedure.

4. Start the generator set and check for oil leaks.
5. Stop the generator set. Check oil level. Add oil, as necessary, to bring level up to Full mark.

## 3.4 Fuel System

### 3.4.1 Fuel Specifications

Use a clean, good-quality unleaded fuel with an octane number of 87. Use fresh gasoline to ensure it is blended for the season and to reduce the possibility of the formation of gum deposits that could clog the fuel system. Do not use gasoline left over from the previous season.

Kohler Co. recommends unleaded fuel because it leaves fewer combustion chamber deposits. Never mix oil with fuel.


**Note:** Consult the engine owner's manual for oxygenated fuel recommendations.

### 3.4.2 Fuel Filter

The 5/7.3ECD generator sets utilize an in-line type fuel filter. See Section 1 for the fuel filter location. Replace the filter every 500 hours of running time or when rough operation indicates an engine tune-up may be necessary. Bleed the fuel system (after replacing the fuel filter). See Section 3.4.3.

### 3.4.3 Fuel System Bleed

Bleed air from the fuel system in order to reduce rough running or vapor lock.

<b>⚠ WARNING</b>

<b>Fire.</b> <b>Can cause severe injury or death.</b>  Do not smoke or permit flames or sparks near fuels or the fuel system.

**Servicing the fuel system. A flash fire can cause severe injury or death.** Do not smoke or permit flames or sparks near the carburetor, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or carburetor.

#### Fuel System Bleed Procedure

1. Press and hold the Select button on the ADC. See Figure 3-4.
2. While holding the Select button, move the generator set master switch into the RUN position. See Figure 3-4.
3. Keep holding the Select button until step 6. The ADC software version and then FUEL will appear on the ADC's LED display. See Figure 3-4.
4. Remove the cap from the location shown in Figure 3-5.
5. Hold the bleed tool (part number GM46327) onto the bleed point to remove air from the line.
6. When fuel begins to drip from the hose (on the bleed tool) release the Select button and replace the cap.

**Note:** Use a container at the end of the bleed tool's hose to catch the fuel. Dispose of fuel in an environmentally safe manner.

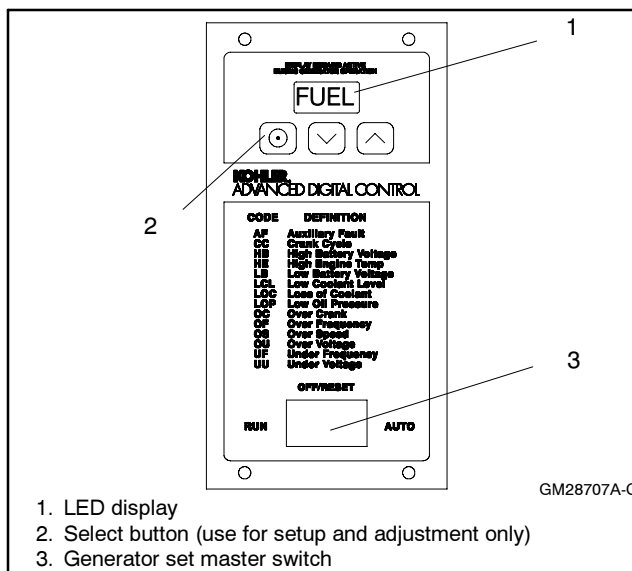


Figure 3-4 ADC 2100 Control

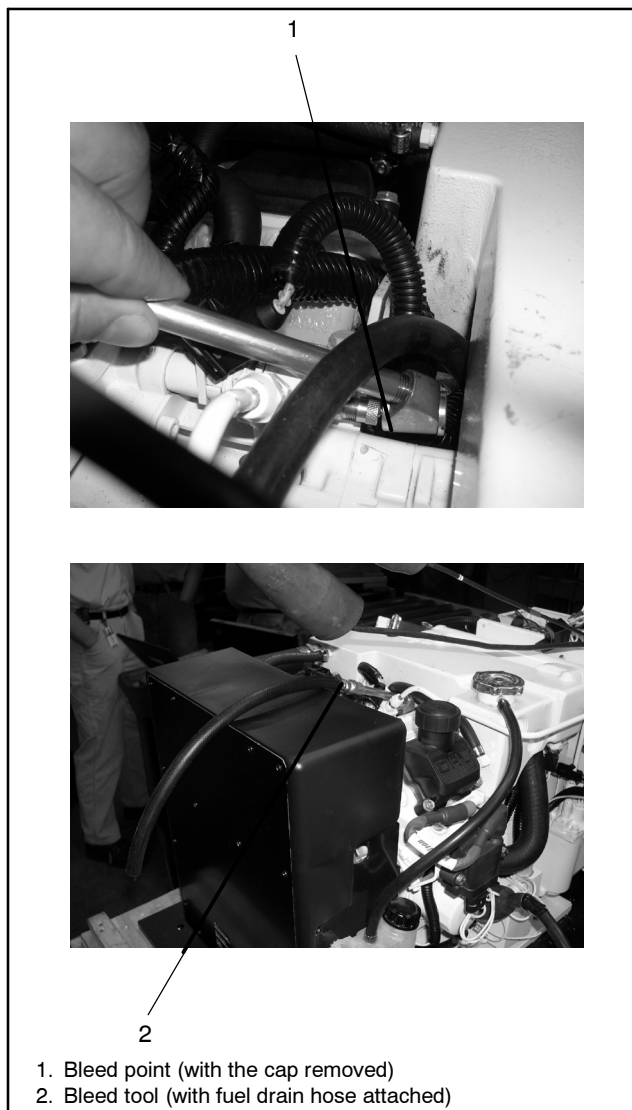


Figure 3-5 Bleed Location

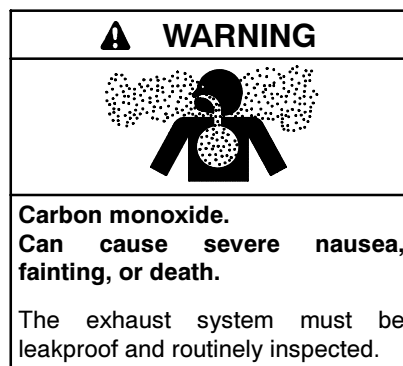
### 3.5 Backfire Flame Arrestor

At the interval specified in the service schedule, inspect, clean, *or replace* the backfire flame arrestor. Clean the arrestor more frequently if the generator set operates in dirty, dusty conditions. Check the element for accumulated oil or dirt that could clog the element and cause poor performance. See Section 1 for location. Replace a damaged flame arrestor. Use only USCG-approved Kohler replacement parts. Follow the procedure described below.

#### Backfire Flame Arrestor Cleaning Procedure

1. Loosen the hose clamp at the breather hose at the air silencer fitting and remove the hose.
2. Loosen the hose clamp attaching the air silencer assembly to the carburetor.
3. Lift off the air silencer assembly.
4. Clean the assembly in evaporative solvent and wipe clean. Allow to dry.
5. Reassemble using the reverse sequence.

### 3.6 Exhaust System



**Inspecting the exhaust system. Carbon monoxide can cause severe nausea, fainting, or death.** For the safety of the craft's occupants, install a carbon monoxide detector. Consult the boat builder or dealer for approved detector location and installation. Inspect the detector before each generator set use. In addition to routine exhaust system inspection, test the carbon monoxide detector per the manufacturer's instructions and keep the detector operational at all times.

At the interval specified in the service schedule, inspect the exhaust system components (exhaust manifold, catalyst assembly, gasket(s), exhaust hose, hose clamps, silencer, and outlet flapper) for cracks, leaks, and corrosion.

Ensure that the carbon monoxide detector(s) is (1) in the craft, (2) functional, and (3) energized whenever the generator set operates.

**For your safety: Never operate the generator set without a functioning carbon monoxide detector(s) for your safety and the safety of others on your vessel.**

#### Exhaust System Inspection Points

Check for exhaust leaks and blockages. Check the silencer and piping condition and check for tight exhaust system connections.

- Check the hoses for softness, cracks, leaks, or dents. Replace the hoses as needed.
- Check for corroded or broken metal parts and replace them as needed.
- Check for loose, corroded, or missing clamps. Tighten or replace the hose clamps and/or hangers as needed.
- Check that the exhaust outlet is unobstructed.
- Visually inspect the exhaust system for exhaust leaks (*blowby*). Check for carbon or soot residue on exhaust components. Carbon and soot residue indicates an exhaust leak. Seal leaks as needed.

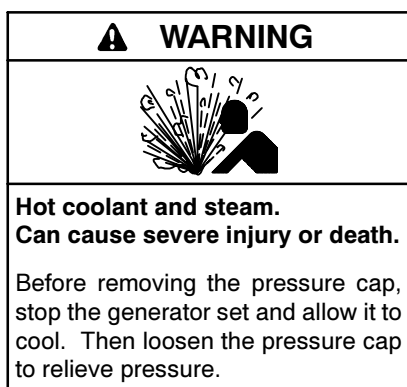
## 3.7 Cooling System

### 3.7.1 Closed Heat Exchanger

In a closed cooling system, the seawater circulates through separate chambers within the heat exchanger to cool the engine water. The seawater then mixes with engine exhaust and ejects out the exhaust outlet. See Figure 3-6 for coolant capacity (include coolant recovery tank capacity of 0.8 L (0.85 qts.). See Figure 3-7 for thermostat and pressure cap ratings.

Model	L (Qts.)
All models	2.84 (3.0)

Figure 3-6 Coolant Capacity



**Checking the coolant level. Hot coolant can cause severe injury or death.** Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

#### NOTICE

**Saltwater damage.** Saltwater quickly deteriorates metals. Wipe up saltwater on and around the generator set and remove salt deposits from metal surfaces.

#### Checking and Filling Coolant

Maintain the coolant level in coolant recovery tank at approximately 1/4 full. Before filling the cooling system, close all petcocks and tighten all hose clamps. Use a solution of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion and prevent freezing. Add additional coolant, as necessary, to the coolant recovery tank. Periodically check the coolant level on closed systems by removing the pressure cap. Do not rely solely on level in coolant recovery tank. Add fresh coolant until the level is just below the overflow tube opening.

Do not add coolant to a hot engine. Adding coolant to a hot engine can cause the cylinder block or cylinder head to crack. Wait until engine has cooled.

**Note: Coolant solution.** A coolant solution of 50% ethylene glycol provides freezing protection to -37°C (-34°F) and overheating protection to 129°C (265°F). A coolant solution with less than 50% ethylene glycol may not provide adequate freezing and overheating protection. A coolant solution with more than 50% ethylene glycol can cause engine or component damage. Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Consult the engine manufacturer's operation manual for engine coolant specifications.

Model	5/7.3ECD
Pressure Cap Rating	96.5 kPa (14 psi)
Thermostat Rating	91°C (195°F)

Figure 3-7 Pressure Cap and Thermostat Rating

#### Procedure for Flushing and Cleaning Cooling System

For optimum protection drain, flush, and refill the cooling system at the interval listed in the service schedule.

Pay special attention to the coolant level. After the coolant drains, allow time for complete refill of the engine water jacket. Check the coolant level as described earlier.

1. Remove the hose clamp at the coolant hose. See Section 1 for location of the hose.
2. Remove the pressure cap to make draining easier.
3. Drain, clean, and flush the coolant recovery tank.
4. Flush the system with clean water.
5. Replace the hose clamp to secure the coolant hose.
6. Fill the system with the recommended coolant.
7. Replace the pressure cap.

### 3.7.2 Pressure Cap

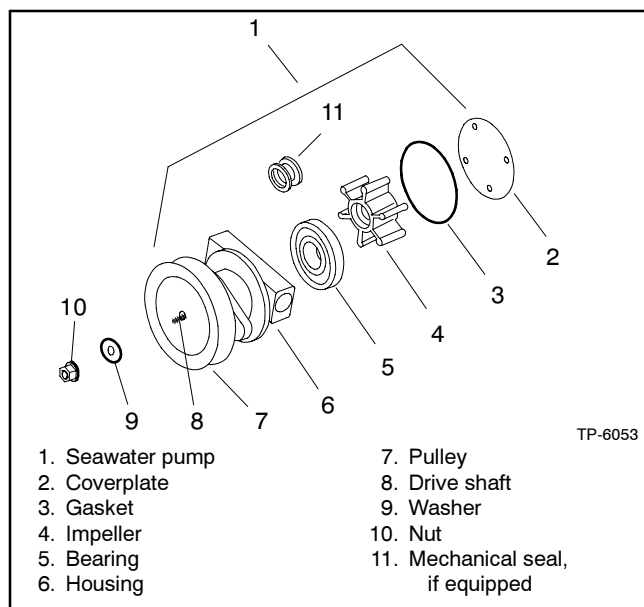
Closed heat exchanger systems utilize a pressure cap to raise the boiling point of the coolant, enabling higher operating temperatures. If the cap leaks, replace it with a cap of the same rating. Find the pressure cap rating in Figure 3-7.

### 3.7.3 Seawater Pump

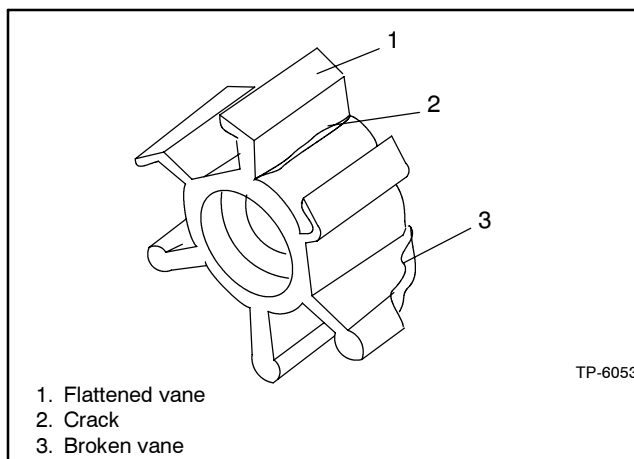
The direct-driven seawater pump is located on the generator end of the generator set. Check and change the seawater pump impeller at the interval specified in the service schedule. Follow the instructions included with the impeller kit. If the instructions are not included with the kit, use the following procedure:

#### Impeller Inspection and Replacement Procedure:

1. Close the seacock.
2. Remove the seawater pump coverplate. See Figure 3-8.
3. Remove the impeller.
4. Inspect the impeller for damaged, cracked, broken, missing or flattened vanes. The impeller vanes should be straight and flexible. See Figure 3-9. Replace the impeller if it is damaged.



**Figure 3-8** Seawater Pump, Typical



**Figure 3-9** Worn Impeller

5. Lubricate the impeller with soapy water before installation.
6. Install the impeller.

**Note:** During installation push and rotate the impeller in the same direction as the engine rotation until it is thoroughly seated in the impeller housing.

7. Inspect the coverplate and gasket for corrosion and/or damage. Replace components as necessary.
8. Lubricate the gasket with silicon grease and attach the gasket and coverplate to the seawater pump housing.
9. Open the seacock.
10. Start the generator set and check for leaks.
11. Stop the generator set and repair leaks or replace damaged or worn components.

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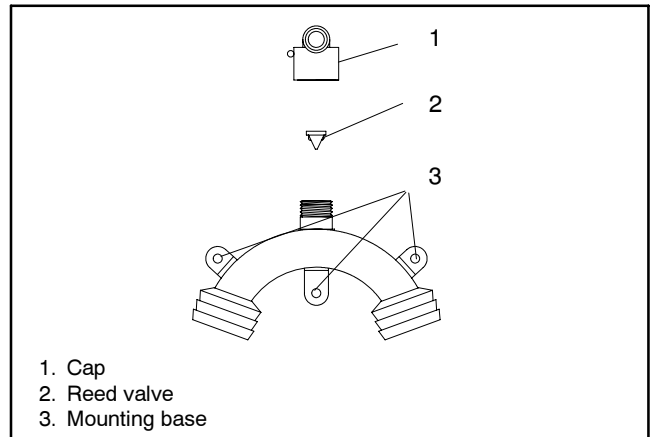
### 3.7.4 Siphon Break

A siphon break prevents seawater entry into the generator set's engine when the engine exhaust manifold outlet is less than 230 mm (9 in.) above the waterline of a fully loaded, docked or stationary craft. See Figure 3-11. The siphon break may malfunction when the generator set operates while the craft is in contaminated waters or saltwater. Use the following procedure to inspect the siphon break at the intervals listed in the service schedule.

#### Siphon Break Inspection

1. Stop the generator set.
2. Remove the retaining cap and remove the reed valve for inspection. See Figure 3-10.
3. Use a mild detergent to remove residue and oxidation from the reed valve.
4. Clear blockage from the reed valve opening.
5. Replace the siphon break if the reed valve is cracked or if the reed valve material has hardened or deteriorated.

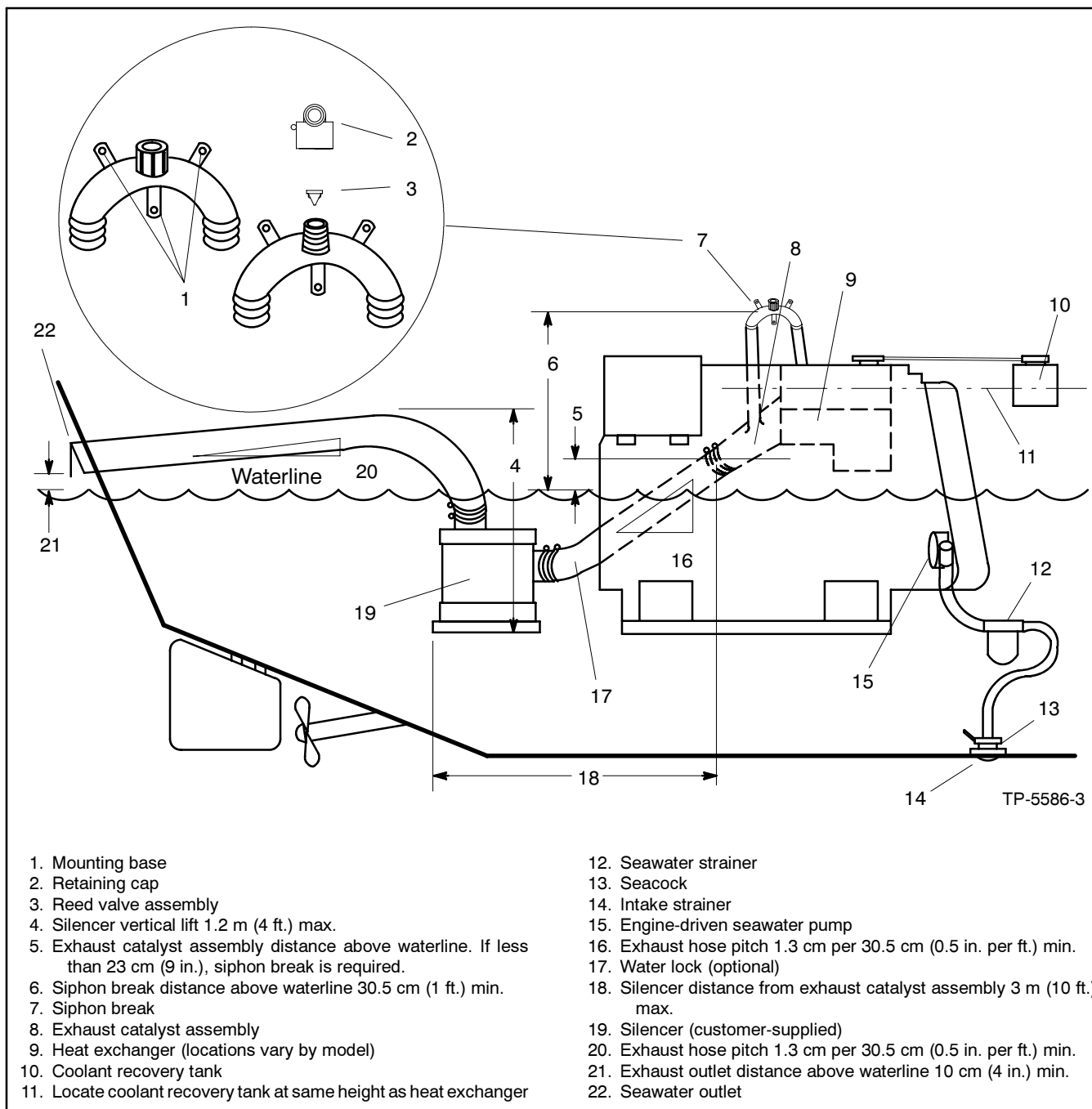
6. Install the reed valve into the mounting base with the valve downward. See Figure 3-10, item 2.
7. Install and only finger tighten the retaining cap. Do not overtighten it.



**Figure 3-10** Siphon Break

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**Figure 3-11** Siphon Break (Plastic "U" Type) Installation

**Note:** Consult the installation manual for complete explanation of dimensions and other installation considerations.

3.7.5 Anticorrosion Zinc Anode

The heat exchanger on these models contains an anticorrosion zinc anode (plug) to prevent electrolytic corrosion by seawater.

Check and replace the anticorrosion zinc anode at intervals recommended in the service schedule. Depending upon operating conditions and seawater properties, the anticorrosion zinc anode may require more frequent replacement. See Section 1—Service Views for location and use the following procedure.

Anticorrosion Zinc Anode Replacement Procedure

- 1. With the generator set cooled, close the seacock, remove the anticorrosion zinc plug from the heat exchanger, and drain the coolant into a suitable container.
- 2. Use a wire brush to remove the loose corrosion on the anticorrosion zinc anode. Replace the anode according to Figure 3-12 and Figure 3-13.

Anticorrosion Zinc Anode Replacement		
Models	New Anode Dimensions mm (in.)	Replace When Percent of Zinc Remaining Is:
5/7.3ECD and 4/6EFCD	9 (0.34) x 43 (1.7)	<50% of length/diameter

Figure 3-12 Anticorrosion Zinc Anode (Plug) Measurements

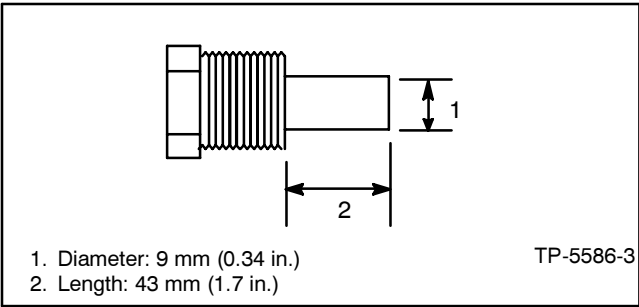


Figure 3-13 Anticorrosion Zinc Anode (Plug)

- 3. Clean the threaded hole of the heat exchanger and coat the threads of the anticorrosion zinc anode (plug) with pipe sealant suitable for marine applications. Install the anticorrosion zinc anode into the heat exchanger.
- 4. Open the seacock. Refill the cooling system.
- 5. Start the generator set and check for leaks at the anticorrosion zinc anode location. The pump is operating if cooling water flows from the exhaust outlet. If water is not discharging at the exhaust outlet, see Prestart Checklist—Seawater Pump Priming.

3.7.6 Seawater Outlet

Check the seawater outlet at the interval specified in the service schedule. See Figure 3-11 for location. Remove any obstructions to keep the outlet clear.

## 3.8 Ignition System

Service spark plugs at the interval specified in the service schedule using the following procedure.

### Spark Plug Service Procedure

1. Remove spark plug wires by grasping the spark plug boot and turning slightly while pulling. Do not pull the wire. Pulling on the wire rather than the boot may damage the wire or terminal.
2. Loosen the spark plug with a ratchet and 5/8-in. spark plug socket with a rubber insert to prevent spark plug damage.
3. Use compressed air to remove dirt from around each spark plug to prevent dirt particles from falling into the combustion chamber.
4. Remove spark plugs, one at a time, and examine. Identify a normal spark plug in good operating condition by observing a light tan or gray deposit on the firing tip. See Figure 3-14 to evaluate engine condition by color/condition of a problem spark plug.

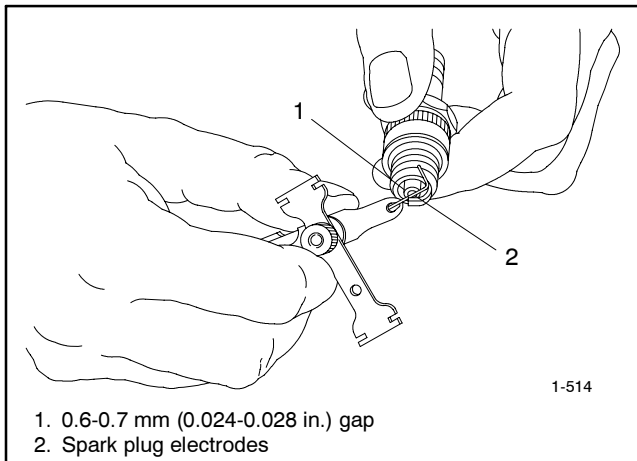
Problem/Condition	Means of Identification	Possible Cause/Solution
<b>Gap-bridged spark plug</b>	Built-up deposits and gap between electrodes closing.	Oil or carbon fouling. Clean and regap the spark plug.
<b>Oil-fouled spark plug</b>	Wet, black deposits on the insulator shell, bore, and electrodes.	Excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings. Replace the spark plug.
<b>Carbon-fouled spark plug</b>	Black, dry, fluffy carbon deposits on insulator tips, exposed shell surfaces and electrodes.	Incorrect spark plug, weak ignition, clogged air intake, defective fuel pump, overrich fuel mixture, or excessive no-load operation. Clean and regap the spark plug.
<b>Lead-fouled spark plug</b>	Dark gray, black, yellow, or tan deposits; or a glazed coating on the insulator tip.	Caused by highly leaded fuel. Replace the spark plug.
<b>Preignition damaged spark plug</b>	Melted electrodes and possibly blistered insulator. Metallic deposits on insulator suggest internal engine damage.	Wrong type of fuel, incorrect timing or advance, too hot a plug, burned valves, or engine overheating. Replace the spark plug.
<b>Overheated spark plug</b>	White or light gray insulator with small black or gray/brown spots with bluish (burned) appearance on electrodes.	Engine overheating, wrong type of fuel, loose spark plugs, too hot a plug, low fuel pump pressure or incorrect ignition timing. Replace the spark plug.
<b>Worn spark plug</b>	Severely eroded or worn electrodes.	Caused by normal wear and failure to replace spark plug at prescribed interval. Replace the spark plug.

**Figure 3-14** Engine Evaluation Using Spark Plug Condition

5. Clean spark plugs by wiping them with a rag. File the center electrode to keep it parallel to the side electrode.

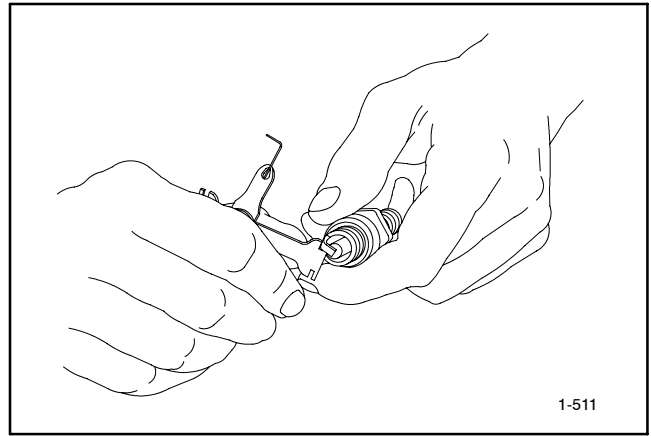
**Note:** Do not sandblast, wire brush, scrape, or otherwise service spark plug in poor condition. Obtain a new plug for best results.

6. Check the spark plug gap before installing any spark plug. See Figure 3-15. Attain a correct gap when the feeler (or wire) passes between the spark plug electrode. It should pass easily but with some resistance or drag; otherwise adjust as necessary. The correct gap is 0.6-0.7 mm (0.024-0.028 in.).



**Figure 3-15** Spark Plug Gap Inspection

7. Use a gapping tool to gently bend the side electrode closer to or farther from the center electrode to set the correct gap. See Figure 3-16. Position the side electrode directly over the center electrode.



**Figure 3-16** Spark Plug Gap Adjustment

8. Reinstall the spark plug. Do not bump the electrode against the cylinder head. Rotate the spark plug clockwise until feeling resistance.
9. Use a torque wrench to torque each spark plug to 12-17 Nm (9-12 ft. lbs.). Otherwise, hand-tighten spark plug until feeling resistance.
10. Use a ratchet wrench to final tighten an additional 1/4 turn. Do not overtighten, as doing so may strip threads or alter electrode gap setting.
11. Check spark plug wire connector in boot for accumulated dirt, grease, and other debris, and clean as necessary.
12. Firmly push spark plug boot onto spark plug.

## 3.9 Battery

Consult the battery manufacturer's instructions regarding battery care and maintenance.

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### WARNING



**Sulfuric acid in batteries.  
Can cause severe injury or death.**

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

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## 3.10 Generator Storage Procedure

Keep the craft afloat for generator operation during the storage procedure. Follow the procedure below when storing your generator set for a long period (3 months or more).

1. Start and run the generator set until it reaches operating temperature or about 15 minutes.
2. Stop the generator set.
3. Change the oil and oil filter; see Section 3.3.4—Oil Change and Section 3.3.5—Oil Filter Change.
4. Close the seacock and remove the hose at the seacock. Place the hose in a container having approximately 3.7-7.5 L (1-2 U.S. gallons) of coolant/antifreeze. Kohler Co. recommends using an environmentally friendly potable antifreeze such as Peak® RV/marine propylene glycol/water mix or equivalent.
5. Disconnect the lead (#87) to the low seawater pressure (LWP) switch.

6. With a suitable container at the exhaust outlet, run the generator set until coolant discharges at the exhaust outlet or until depleting the coolant mixture. Do not allow coolant mixture to flow into waterways.

7. Reconnect the lead (#87) to the low seawater pressure (LWP) switch.
8. Stop the generator set.
9. Connect the hose to the seacock. Leave the seacock closed.
10. Check the coolant level of the heat exchanger and add coolant if necessary.

**Note:** Use antifreeze capable of withstanding the lowest possible temperatures.

11. Drain fuel completely from the fuel tank.
12. Clean the exterior of the generator set and spread a light film of oil or silicon spray over any exposed surfaces that may be subject to rust or corrosion.
13. Keep spark plugs in their holes or seal spark plug holes with suitable threaded metal plugs.
14. Seal the air inlet, exhaust pipe, and fuel tank cap with tape.
15. Disconnect and remove the battery. Place the battery in a warm, dry location for the storage period. Recharge the battery once a month to maintain a full charge.
16. Select a well-ventilated (not humid or dusty) location to store the generator.
17. Cover the entire unit with a dust cover.

**Note:** Run the generator set once a month whenever possible.

## Notes

## Section 4 Troubleshooting

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This section contains generator set troubleshooting, diagnostic, and repair information.

Use the following charts as a quick troubleshooting reference. The table groups generator set faults and suggests likely causes and remedies. The table also refers you to more detailed information including sections of this manual, the generator set service manual (S/M), the generator set installation manual (I/M), and the engine service manual (Engine S/M) to correct the indicated problem.

Use the following charts to diagnose and correct common problems. First check for simple causes such as a dead engine starting battery, loose connections, or an open circuit breaker. The charts include a list of common problems, possible causes of the problem, and recommended corrective actions.

Corrective action and testing often require knowledge of electrical and electronic circuits. To avoid additional problems caused by incorrect repairs, have an authorized service distributor/dealer perform service.

### NOTICE

**Fuse replacement.** Replace fuses with fuses of the same ampere rating and type (for example: 3AB or 314, ceramic). Do not substitute clear glass-type fuses for ceramic fuses. Refer to the wiring diagram when the ampere rating is unknown or questionable.

Maintain a record of repairs and adjustments performed on the equipment. If the procedures in this manual do not explain how to correct the problem, contact an authorized distributor/dealer. Use the record to help describe the problem and repairs or adjustments made to the equipment.

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Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Controller												
x									Generator set master switch in the OFF position	Move the generator set master switch to the correct position (RUN or AUTO).	Section 2	
			x	x					The auxiliary winding fuse (F1) blown	Replace the blown F1 fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D	
x	x		x	x					The controller fuse (F2) blown	Replace the blown F2 fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D	
x				x					The customer connection fuse (F3) blown. Note that the remote digital gage (if equipped) will not function.	Replace the blown F3 fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D	
	x								The coil/injector fuse (F4) blown	Replace the blown F4 fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D	
	x	x	x	x	x			x	The ECM, O <sub>2</sub> sensor, and fuel pumps fuse (F5) blown	Replace the blown F5 fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D	
x		x							The battery charging alternator and voltage regulator fuse (F6) blown	Replace the blown F6 fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D	
x									The starter motor and crank solenoid fuse (F7) blown	Replace the blown F7 fuse. If the fuse blows again, troubleshoot the controller.†	Section 2, W/D	
x				x					Controller circuit breaker tripped	Reset the controller circuit breaker.	Section 2	
x									Controller master or start/stop switch inoperative	Replace the controller master or start/stop switch.	—	
			x						Incorrect controller settings	Check and adjust the controller.†	I/M	
				x					Remote stop command received from a remote switch	Check and remote switch position.		
				x					Controller fault	Troubleshoot the controller.†	Gen. S/M	
x	x								Controller circuit board(s) inoperative	Replace the controller circuit board.	Gen. S/M	
Cooling System												
						x		x	Air openings clogged	Clean the air openings.	—	
						x			Impeller damaged	Replace the impeller.	Section 3	
						x		x	Seawater strainer clogged or restricted	Clean the strainer.	Section 3	
				x					High temperature shutdown	Allow the engine to cool down. Then troubleshoot the cooling system (add coolant).	Sec. 3, Eng. O/M	
						x			Coolant level low	Restore the coolant to normal operating level.	Section 3	
						x			Thermostat inoperative	Replace the thermostat.	Eng. S/M	

\* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

† Have an authorized service distributor/dealer perform this service.

\* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram

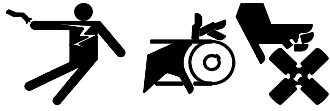
† Have an authorized service distributor/dealer perform this service.



Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Crank but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Electrical System (DC circuits)												
x	x									Battery connections loose, corroded, or incorrect	Verify that the battery connections are correct, clean, and tight.	Section 3
x	x									Battery weak or dead	Recharge or replace the battery. The spec sheet provides recommended battery CCA rating.	Section 3, S/S
x				x						Engine harness connector(s) not locked tight	Disconnect the engine harness connector(s) then reconnect it to the controller.	W/D
				x						Fault shutdown	Reset the controller.	Section 2
				x						High exhaust temperature switch inoperative	Replace the inoperative switch.	Gen. S/M or W/D
x	x									Starter/starter solenoid inoperative	Replace the starter or starter solenoid.	Eng. S/M
				x						High water temperature switch inoperative	Replace the inoperative switch.	Gen. S/M or W/D
	x									Faulty ground connection	Clean and retighten the connection.	—
Engine												
	x	x			x			x		Air cleaner/backfire flame arrestor clogged	Clean or replace the filter element.	Section 2
	x	x				x		x	x	Compression weak	Check the compression.†	Eng. S/M
			x		x	x		x	x	Engine overload	Reduce the electrical load. See the generator set installation manual for wattage specifications.	I/M
									x	Exhaust system leak	Inspect the exhaust system. Replace the inoperative exhaust system components.†	Section 3, I/M
									x	Exhaust system not securely installed	Inspect the exhaust system. Tighten the loose exhaust system components.†	Section 3, I/M
					x				x	Valve clearance incorrect	Adjust the valves.†	Eng. S/M
									x	Vibration excessive	Tighten all loose hardware.	—
	x	x			x					Ignition system inoperative (gas/gasoline only)	Check the ignition system (ignition module, spark plugs, spark plug wires, etc.).	Eng. O/M
* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram												
† Have an authorized service distributor/dealer perform this service.												

Trouble Symptoms										Probable Causes	Recommended Actions	Section or Publication Reference*
Does not crank	Cranks but does not start	Starts hard	No or low output voltage	Stops suddenly	Lacks power	Overheats	Low oil pressure	High fuel consumption	Excessive or abnormal noise			
Fuel System												
	x			x					Fuel tank empty or fuel valve shut off	Add fuel and move the fuel valve to the ON position.	—	
	x				x				Fuel pressure insufficient	Check the fuel supply and valves. †	S/S, Gen. O/M	
	x	x		x	x				Fuel line restriction	Check the fuel lines and fuel tank.	Eng. O/M	
	x	x			x				Stale or bad fuel. Incorrect type of fuel	Replace fuel. Clean the carburetor.	Sec. 3, Eng S/M	
	x				x			x	Fuel feed pump inoperative	Replace the fuel feed pump. †	Eng. S/M	
Generator												
			x						AC output circuit breaker open	Reset the breaker and check for AC voltage at the generator side of the circuit breaker.	—	
				x					Overcrank shutdown	Reset the controller. If the overcrank fault occurs again, contact the distributor/dealer.	—	
x									Transfer switch test switch in the OFF position	Move the transfer switch test switch to the AUTO position.	ATS O/M	
			x						Wiring, terminals, or pin in the exciter field open	Check for continuity.	Gen. S/M, W/D	
			x						Main field (rotor) inoperative (open or grounded)	Test and/or replace the rotor. †	Gen. S/M	
			x						Stator inoperative (open or grounded)	Test and/or replace the stator. †	Gen. S/M	
								x	Vibration excessive	Tighten loose components. †	—	
Lube System												
						x	x		Oil level low	Restore the oil level. Inspect the generator set for oil leaks.	Eng. O/M	
					x				Low oil pressure shutdown	Check the oil level.	Eng. O/M	
				x					Low oil pressure (LOP) switch inoperative	Replace the LOP switch.	W/D	
	x	x					x		Crankcase oil type incorrect for ambient temperature	Change the oil. Use oil with a viscosity suitable for the operating climate.	Eng. O/M	
* Sec./Section—numbered section of this manual; ATS—Automatic Transfer Switch; Eng.—Engine; Gen.—Generator Set; I/M—Installation Manual; O/M—Operation Manual; S/M—Service Manual; S/S—Spec Sheet; W/D—Wiring Diagram												
† Have an authorized service distributor/dealer perform this service												

### WARNING

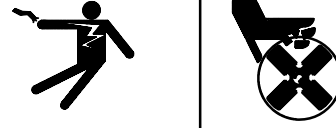


**Accidental starting.  
Can cause severe injury or death.**

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

**Disabling the generator set. Accidental starting can cause severe injury or death.** Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

### WARNING

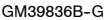


**Hazardous voltage. Moving rotor.  
Can cause severe injury or death.**

Operate the generator set only when all guards and electrical enclosures are in place.

**Grounding electrical equipment. Hazardous voltage can cause severe injury or death.** Electrocutation is possible whenever electricity is present. Turn off the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

### Figure 5-1 Point-to-Point Wiring Diagram (Sheet 1 of 2)



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## Notes



# Appendix A Abbreviations

The following list contains abbreviations that may appear in this publication.

A, amp	ampere	CG	center of gravity	fglass.	fiberglass
ABDC	after bottom dead center	CID	cubic inch displacement	FHM	flat head machine (screw)
AC	alternating current	CL	centerline	fl. oz.	fluid ounce
A/D	analog to digital	cm	centimeter	flex.	flexible
ADC	analog to digital converter	CMOS	complementary metal oxide substrate (semiconductor)	freq.	frequency
adj.	adjust, adjustment			FS	full scale
ADV	advertising dimensional drawing	cogen.	cogeneration	ft.	foot, feet
AHWT	anticipatory high water temperature	Com	communications (port)	ft. lbs.	foot pounds (torque)
AISI	American Iron and Steel Institute	conn.	connection	ft./min.	feet per minute
ALOP	anticipatory low oil pressure	cont.	continued	g	gram
alt.	alternator	CPVC	chlorinated polyvinyl chloride	ga.	gauge (meters, wire size)
Al	aluminum	crit.	critical	gal.	gallon
ANSI	American National Standards Institute (formerly American Standards Association, ASA)	CRT	cathode ray tube	gen.	generator
		CSA	Canadian Standards Association	genset	generator set
		CT	current transformer	GFI	ground fault interrupter
		Cu	copper	GND, ⊕	ground
AO	anticipatory only	cu. in.	cubic inch	gov.	governor
API	American Petroleum Institute	cw.	clockwise	gph	gallons per hour
approx.	approximate, approximately	CWC	city water-cooled	gpm	gallons per minute
AR	as required, as requested	cyl.	cylinder	gr.	grade, gross
AS	as supplied, as stated, as suggested	D/A	digital to analog	GRD	equipment ground
ASE	American Society of Engineers	DAC	digital to analog converter	gr. wt.	gross weight
ASME	American Society of Mechanical Engineers	dB	decibel	H x W x D	height by width by depth
assy.	assembly	dBA	decibel (A weighted)	HC	hex cap
ASTM	American Society for Testing Materials	DC	direct current	HCHT	high cylinder head temperature
		DCR	direct current resistance	HD	heavy duty
ATDC	after top dead center	deg., °	degree	HET	high exhaust temperature
ATS	automatic transfer switch	dept.	department	hex	hexagon
auto.	automatic	dia.	diameter	Hg	mercury (element)
aux.	auxiliary	DI/EO	dual inlet/end outlet	HH	hex head
A/V	audiovisual	DIN	Deutsches Institut für Normung e. V. (also Deutsche Industrie Normenausschuss)	HHC	hex head cap
avg.	average			HP	horsepower
AVR	automatic voltage regulator	DIP	dual inline package	hr.	hour
AWG	American Wire Gauge	DPDT	double-pole, double-throw	HS	heat shrink
AWM	appliance wiring material	DPST	double-pole, single-throw	hsg.	housing
bat.	battery	DS	disconnect switch	HVAC	heating, ventilation, and air conditioning
BBDC	before bottom dead center	DVR	digital voltage regulator		
BC	battery charger, battery charging	E, emer.	emergency (power source)	HWT	high water temperature
BCA	battery charging alternator	EDI	electronic data interchange	Hz	hertz (cycles per second)
BCI	Battery Council International	EFR	emergency frequency relay	IC	integrated circuit
BDC	before dead center	e.g.	for example ( <i>exempli gratia</i> )	ID	inside diameter, identification
BHP	brake horsepower	EG	electronic governor	IEC	International Electrotechnical Commission
blk.	black (paint color), block (engine)	EGSA	Electrical Generating Systems Association	IEEE	Institute of Electrical and Electronics Engineers
blk. htr.	block heater	EIA	Electronic Industries Association	IMS	improved motor starting
BMEP	brake mean effective pressure	EI/EO	end inlet/end outlet	in.	inch
bps	bits per second	EMI	electromagnetic interference	in. H <sub>2</sub> O	inches of water
br.	brass	emiss.	emission	in. Hg	inches of mercury
BTDC	before top dead center	eng.	engine	in. lbs.	inch pounds
Btu	British thermal unit	EPA	Environmental Protection Agency	Inc.	incorporated
Btu/min.	British thermal units per minute			ind.	industrial
C	Celsius, centigrade	EPS	emergency power system	int.	internal
cal.	calorie	ER	emergency relay	int./ext.	internal/external
CARB	California Air Resources Board	ES	engineering special, engineered special	I/O	input/output
CB	circuit breaker	ESD	electrostatic discharge	IP	iron pipe
cc	cubic centimeter	est.	estimated	ISO	International Organization for Standardization
CCA	cold cranking amps	E-Stop	emergency stop	J	joule
ccw.	counterclockwise	etc.	et cetera (and so forth)	JIS	Japanese Industry Standard
CEC	Canadian Electrical Code	exh.	exhaust	k	kilo (1000)
cfh	cubic feet per hour	ext.	external	K	kelvin
cfm	cubic feet per minute	F	Fahrenheit, female	KA	kiloampere
				KB	kilobyte (2 <sup>10</sup> bytes)

kg	kilogram	MW	megawatt	rms	root mean square
kg/cm <sup>2</sup>	kilograms per square centimeter	mW	milliwatt	rnd.	round
kgm	kilogram-meter	μF	microfarad	ROM	read only memory
kg/m <sup>3</sup>	kilograms per cubic meter	N, norm.	normal (power source)	rot.	rotate, rotating
kHz	kilohertz	NA	not available, not applicable	rpm	revolutions per minute
kJ	kilojoule	nat. gas	natural gas	RS	right side
km	kilometer	NBS	National Bureau of Standards	RTV	room temperature vulcanization
kOhm, kΩ	kilo-ohm	NC	normally closed	SAE	Society of Automotive Engineers
kPa	kilopascal	NEC	National Electrical Code	scfm	standard cubic feet per minute
kph	kilometers per hour	NEMA	National Electrical Manufacturers Association	SCR	silicon controlled rectifier
kV	kilovolt	NFPA	National Fire Protection Association	s, sec.	second
kVA	kilovolt ampere	Nm	newton meter	SI	<i>Système international d'unités</i> , International System of Units
kVAR	kilovolt ampere reactive	NO	normally open	SI/EO	side in/end out
kW	kilowatt	no., nos.	number, numbers	sil.	silencer
kWh	kilowatt-hour	NPS	National Pipe, Straight	SN	serial number
kWm	kilowatt mechanical	NPSC	National Pipe, Straight-coupling	SPDT	single-pole, double-throw
L	liter	NPT	National Standard taper pipe thread per general use	SPST	single-pole, single-throw
LAN	local area network	NPTF	National Pipe, Taper-Fine	spec, specs	specification(s)
L x W x H	length by width by height	NR	not required, normal relay	sq.	square
lb.	pound, pounds	ns	nanosecond	sq. cm	square centimeter
lbm/ft <sup>3</sup>	pounds mass per cubic feet	OC	overcrank	sq. in.	square inch
LCB	line circuit breaker	OD	outside diameter	SS	stainless steel
LCD	liquid crystal display	OEM	original equipment manufacturer	std.	standard
ld. shd.	load shed	OF	overfrequency	stl.	steel
LED	light emitting diode	opt.	option, optional	tach.	tachometer
Lph	liters per hour	OS	oversize, overspeed	TD	time delay
Lpm	liters per minute	OSHA	Occupational Safety and Health Administration	TDC	top dead center
LOP	low oil pressure	OV	overvoltage	TDEC	time delay engine cooldown
LP	liquefied petroleum	oz.	ounce	TDEN	time delay emergency to normal
LPG	liquefied petroleum gas	p., pp.	page, pages	TDES	time delay engine start
LS	left side	PC	personal computer	TDNE	time delay normal to emergency
L <sub>wa</sub>	sound power level, A weighted	PCB	printed circuit board	TDOE	time delay off to emergency
LWL	low water level	pF	picofarad	TDON	time delay off to normal
LWT	low water temperature	PF	power factor	temp.	temperature
m	meter, milli (1/1000)	ph., ∅	phase	term.	terminal
M	mega (10 <sup>6</sup> when used with SI units), male	PHC	Phillips head crimptite (screw)	TIF	telephone influence factor
m <sup>3</sup>	cubic meter	PHH	Phillips hex head (screw)	TIR	total indicator reading
m <sup>3</sup> /min.	cubic meters per minute	PHM	pan head machine (screw)	tol.	tolerance
mA	milliampere	PLC	programmable logic control	turbo.	turbocharger
man.	manual	PMG	permanent-magnet generator	typ.	typical (same in multiple locations)
max.	maximum	pot	potentiometer, potential	UF	underfrequency
MB	megabyte (2 <sup>20</sup> bytes)	ppm	parts per million	UHF	ultrahigh frequency
MCM	one thousand circular mils	PROM	programmable read-only memory	UL	Underwriter's Laboratories, Inc.
MCCB	molded-case circuit breaker	psi	pounds per square inch	UNC	unified coarse thread (was NC)
meggar	megohmmeter	pt.	pint	UNF	unified fine thread (was NF)
MHz	megahertz	PTC	positive temperature coefficient	univ.	universal
mi.	mile	PTO	power takeoff	US	undersize, underspeed
mil	one one-thousandth of an inch	PVC	polyvinyl chloride	UV	ultraviolet, undervoltage
min.	minimum, minute	qt.	quart	V	volt
misc.	miscellaneous	qty.	quantity	VAC	volts alternating current
MJ	megajoule	R	replacement (emergency) power source	VAR	voltampere reactive
mJ	millijoule	rad.	radiator, radius	VDC	volts direct current
mm	millimeter	RAM	random access memory	VFD	vacuum fluorescent display
mOhm, mΩ	milliohm	RDO	relay driver output	VGA	video graphics adapter
MOhm, MΩ	megohm	ref.	reference	VHF	very high frequency
MOV	metal oxide varistor	rem.	remote	W	watt
MPa	megapascal	RFI	radio frequency interference	WCR	withstand and closing rating
mpg	miles per gallon	RH	round head	w/	with
mph	miles per hour	RHM	round head machine (screw)	w/o	without
MS	military standard	rly.	relay	wt.	weight
m/sec.	meters per second			xfrm	transformer
MTBF	mean time between failure				
MTBO	mean time between overhauls				
mtg.	mounting				

## Appendix B Operating Hour Service Log

Use the log below to keep a cumulative record of operating hours on your generator set and the dates

required services were performed. Enter hours to the nearest quarter hour.

[illegible]









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